Special Issue on Toward Autonomous Evolution, (Re)production, and Learning in Robotic Ecosystems

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IEEE TRANSACTIONS ON COGNITIVE AND DEVELOPMENTAL SYSTEMS

Special Issue on Toward Autonomous Evolution, (Re)production, and Learning in Robotic Ecosystems

I. AIM AND SCOPE

This Special Issue will include state-of-the-art research on autonomous evolution, reproduction and learning in robotic eco-systems.

Advances in 3-D printing technologies now enable us to print robot bodies from novel materials that flex and electronic circuitry using conducting inks. At the same time, new insights into evolutionary learning and adaptation promise new methods of developing adaptive control. Coupling these together, it is possible to perceive a long-term vision of a new technology enabling the evolution of entire autonomous robotic ecosystems that live and work for long periods in challenging and dynamic environments without the need for direct human oversight. In such a radically new autonomous system, robots will be conceived and born, rather than designed and manufactured. This will fundamentally change the concept of machines. Development is driven by evolution that can discover novel morphologies and controllers that are highly adapted to operate in these environments, which could not have been anticipated by human designer, and can be further enhanced via learning mechanisms that refine an individual's behavior over its lifetime. The result is a new breed of machines that can change their form and behavior, not in error but on purpose.

This Special Issue solicits novel research that will contribute toward achieving such a vision. Although evolving in hardware directly addresses the reality gap, it is clear that this can be complemented and/or accelerated by simulation; significant progress will likely require combining evolution in both hardware and simulation.

II. THEMES

The primary list of topics of interest includes, but is not limited to:

- novel methods for simultaneous evolution of morphology and control;
- novel methods for facilitating learning and adaptation during lifetime;
- evolution of learnability in a robot population;
- investigating the balance between morphological intelligence and brain intelligence;
- robot evolution in hardware;
- evolution of morphologies using novel materials;
- simulation of soft robots;
- closing the reality gap;
- evolving behavioral/morphological diversity within a robotic ecosystem;
- issues related to manufacturability and viability of robotic genotypes;
- surrogate methods for fitness evaluations.

III. SUBMISSION

Manuscripts should be prepared according to the "Information for Authors" of the IEEE TRANSACTIONS ON COGNITIVE AND DEVELOPMENTAL SYSTEMS journal found at https://cis.ieee.org/publications/t-cognitive-and-developmental-systems/tcds-information-for-authors and submissions should be done through the IEEE TCDS Manuscript Central page, which can be found at: https://mc.manuscriptcentral.com/tcds-ieee and select the category "SI: AEPL."

IV. IMPORTANT DATES

15 Feb. 2021—Deadline for manuscript submission

12 Apr. 2021—Notification of authors

12 Jul. 2021—Deadline for revised manuscripts

9 Aug. 2021—Final version

V. GUEST EDITORS

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